

IN THE UNITED STATES DISTRICT COURT  
FOR THE NORTHERN DISTRICT OF NEW YORK

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ENTHONE INC.,

Plaintiff,

Civil Action No.  
1:15-CV-0233 (TJM/DEP)

v.

BASF CORPORATION,

Defendant.

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APPEARANCES:

FOR PLAINTIFF:

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FOR DEFENDANT:

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DAVID E. PEEBLES  
CHIEF U.S. MAGISTRATE JUDGE

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JOSEPH D. ENG, JR., ESQ.

## REPORT AND RECOMMENDATION

This is a patent infringement action involving plaintiff Enthone, Inc. ("Enthone") and BASF Corporation ("BASF"), two direct competitors engaged in the manufacture and sale of specialty chemicals. At issue are two patents, a method patent and a composition patent, involving a damascene process, by which minute trenches and vias on integrated circuits, or microchips, are filled with copper.

Despite their best efforts, the parties have been unable to agree on the proper construction to be accorded to two terms found in the patents in suit. The question of claim construction has been referred to me for the issuance of a report and recommendation. Based upon the parties' written submissions and a claim construction hearing conducted in the case, my recommendations concerning those contested claim terms are set forth below.

### I. BACKGROUND

The patent infringement claims asserted in this action concern the following two patents, both of which bear the title "Copper Electrodeposition in Microelectronics": United States Patent No. 7,303,992 ("992 Patent), issued on December 4, 2007; and United States Patent No.

7,815,786 ("786 Patent), issued on October 19, 2010.<sup>1</sup> The two patents relate to the manufacture of semiconductor integrated circuit devices such as computer chips. See, e.g., '992 Patent 1:1-16.<sup>2</sup>

One conventional step in the manufacture of integrated circuits is the copper damascene process. '992 Patent 1:45-46. Utilizing this process, a circuit architecture is etched into the surface of a semiconductor, comprising extremely small trenches and vias which are then filled with copper to electrically connect the circuit components of the integrated circuit. *Id.* at 1:46-58. Those trenches and vias can be filled by electrochemical deposition, a process intended to enhance "bottom up growth" or "superfilling" to avoid seams and pinching off that can result in voids and adversely effect electrical performance. *Id.* at 1:45-3:13, 2:31-48. This process is accomplished by immersing a semiconductor substrate in a plating bath containing copper ions and additives, which may include suppressors, levelers, and accelerators, and then applying an electrical current to the bath to cause copper to be deposited into the trenches and vias. *Id.* Critical to the success of the damascene process is the need to ensure that the electrolytic copper plating step achieves superfilling, or

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<sup>1</sup> The '992 and '786 Patents are attached to Enthon's first amended complaint as Exhibits A and B, respectively. See Dkt. Nos. 32-1, 32-2.

<sup>2</sup> The specifications of the '992 Patent, which is a method patent, and the later '786 Patent, which describes the corresponding composition, are virtually identical. In this report and recommendation, except where otherwise noted, I will cite to the earlier method patent without cross-referencing to the '786 Patent.

growth from the bottom up, rather than conformal plating, which occurs when there is an equal rate of growth of the copper deposits on all surfaces, including sidewalls of the trenches and vias. *Id.*

The electrolytic plating method and composition disclosed in the two patents typically includes a suppressor compound and a source of copper ions. '992 Patent 4:37-40. The compositions also typically include a leveler, an accelerator, and a chloride. *Id.* at 4:40-41. The focus of the two patents in suit is upon the suppressor compound. The two patents disclose the use of a suppressor compound involving propylene oxide ("PO") repeat units and ethylene oxide ("EO") repeat units, present in a PO:EO ratio in the approximate range of 1:9 to 9:1, bonded to a nitrogen-containing species and falling within a particular range of molecular weights. '992 Patent, 3:25-30.

Enthone and BASF directly compete. According to Enthone, both offer specialty chemicals and solutions to microelectronic manufacturers for use in the electrolytic plating of copper onto semiconductor substrates. Dkt. No. 32 at 2, 4. Based upon information Enthone obtained from BASF, it alleges that BASF sells chemicals that include a specific suppressor that infringes upon one or more of the claims of the two patents in suit.

## II. PROCEDURAL HISTORY

Plaintiff commenced this action on February 27, 2015, and later filed

a first amended complaint on September 4, 2015. Dkt. Nos. 1, 32. In its complaint, as amended, Enthone alleges that BASF infringes the '786 Patent by making, using, selling or offering to sell plating compositions that infringe one or more claims of that patent, and that it actively induces others to infringe the '992 Patent through the offering of its infringing suppressor.<sup>3</sup> BASF has answered Enthone's first amended complaint, denying infringement and asserting various defenses including, *inter alia*, patent invalidity and unenforceability, and additionally has counterclaimed seeking declarations of non-infringement and invalidity. Dkt. No. 36.

In accordance with the court's local patent rules, the parties have conferred and submitted a joint claim construction statement revealing their agreement with respect to several patent claim terms, and a disagreement with regard to the proper construction of two claim terms appearing in both of the patents in suit. See Dkt. No. 34. The question of claim construction has been referred to me for the issuance of a report and recommendation, pursuant to 28 U.S.C. § 636(b)(1)(B).<sup>4</sup> See Dkt. No. 39. In accordance with that referral, a claim construction hearing was conducted on January 22, 2016. At the conclusion of that hearing I

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<sup>3</sup> The claims asserted in this action by Enthone include Claims 1, 5-7, 9-15, 20-22, and 28 of the '992 Patent, and Claims 1-6, 8, and 11-18 of the '786 Patent ("asserted claims"). Dkt. No. 44 at 6-7; see also Dkt. No. 32 at 6, 8.

<sup>4</sup> The original referral order was to the Hon. Daniel J. Stewart, to whom this matter was initially assigned. See Dkt. No. 39. The matter has since been transferred to me.

reserved decision, and advised the parties that I would provide a written report and recommendation to Senior District Judge Thomas J. McAvoy concerning the issue of claim construction.

### III. DISCUSSION

#### A. Claim Construction: The Legal Framework

Patent claim construction presents an issue of law, to be decided by the court. *Aventis Pharma S.A. v. Hospira, Inc.*, 675 F.3d 1324, 1329 (Fed. Cir. 2012); *Cybor Corp. v. FAS Techs., Inc.*, 138 F.3d 1448, 1456 (Fed. Cir. 1998) (*en banc*); see also *Sulzer Textil A.G. v. Picanol N.V.*, 358 F.3d 1356, 1366 (Fed. Cir. 2004) ("The meaning and scope of patent claim terms, as determined by a district court's claim construction rulings, are legal issues central to most patent cases."). "Claim construction is a legal statement of the scope of the patent right; it does not turn on witness credibility, but on the content of the patent documents." *Lighting Ballast Control, LLC v. Philips Elecs. N. Am. Corp.*, 744 F.3d 1272, 1284 (Fed. Cir. 2014) (*en banc*).

As a general rule, a court tasked with construing a patent must assign claim terms their ordinary and customary meanings. *Butamax(TM) Advanced Biofuels LLC v. Gevo, Inc.*, 746 F.3d 1302, 1308-09 (Fed. Cir. 2014); *Thorner v. SONY Computer Entm't Am., LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir.

2005). (en banc). "[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention." *Phillips*, 415 F.3d at 1313; accord, *Thorner*, 669 F.3d 1365; see also *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002) ("Generally speaking, we indulge a 'heavy presumption' that a claim term carries its ordinary and customary meaning."). The person of ordinary skill in the art is 'deemed to read the claim term, not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent,' including the specification and prosecution history."<sup>5</sup> *Cardsoft, LLC v. Verifone, Inc.*, 769 F.3d 1114, 1117 (Fed. Cir. 2014) (quoting *Phillips*, 415 F.3d at 1313).

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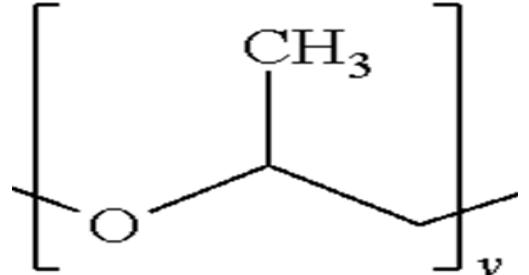
<sup>5</sup> Enthone defines a person of ordinary skill in the art at the time of the invention as including a person possessing "a Ph.D. in chemistry or chemical engineering with a specialization in the field of electrochemistry or electrochemical engineering and about two years' experience in formulating electrolytic plating compositions for filling submicron vias or trenches for semiconductor integrated circuit devices, or a B.S. or M.S. in chemistry or chemical engineering with three to five years' experience in that field." See Dkt. No. 43-6 at 3. BASF offers a slightly different definition, asserting that "[a] person of ordinary skill in the art at the time the alleged inventions of the '992 Patent and '786 Patent were made would have had at least a bachelor's degree in materials science, chemistry, or a related discipline, and would have had approximately two or more years of experience as a process engineer." Dkt. No. 44 at 8. For purposes of claim construction, I do not find it necessary to reconcile these two definitions, or to select one over the other.

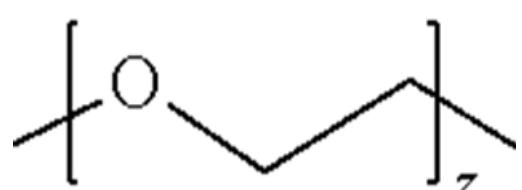
There are two exceptions to the general rule that patent claim terms should be accorded their ordinary and customary meaning. The first involves a circumstance in which a patentee has acted as its own lexicographer, setting out a definition of a term that differs from its ordinary and customary meaning. *Butamax(TM)*, 746 F.3d at 1309; *Thorner*, 669 F.3d at 1365. "To act as its own lexicographer, a patentee must 'clearly set forth a definition of the disputed claim term' other than its plain and ordinary meaning." *Thorner*, 669 F.3d at 1365 (quoting *CCS Fitness, Inc.*, 288 F.3d at 1366); *accord*, *Aventis Pharma S.A.*, 675 F.3d at 1330. Under the second exception, a claim term may also properly be given a meaning that differs from its customary meaning "when the patentee disavows the full scope of a claim term either in the specification or during prosecution." *Butamax(TM)*, 746 F.3d at 1309 (quoting *Thorner*, 669 F.3d at 1366); *accord*, *Aventis Pharma S.A.*, 675 F.3d at 1330. These two exceptions to the rule that patent terms should be given their ordinary meaning are both narrow and exacting. *Thorner*, 669 F.3d at 1366-67.

## B. Claim Construction Analysis

### 1. Undisputed Terms

According to their joint claim construction statement, the parties have reached agreement concerning certain claim terms contained within the two patents in suit, as follows:

'992 Patent Term/Phrase	Claim(s)	Agreed Construction
a method for electroplating a copper deposit onto a semiconductor integrated circuit device substrate with electrical interconnect features including submicron-sized features having bottoms, sidewalls, and top openings, the method comprising:	1	The preamble of claim 1 is a limitation. The terms in the preamble should be given their plain and ordinary meaning.
propylene oxide (PO) repeat units, propylene oxide repeat units, and PO repeat units	1, 5, 6, 12, 13, 20, 21, and 28	the chemical structures in a polyether that are represented by the formula $C_3H_6O$ with the following structure: 

ethylene oxide (EO) repeat units	1, 5, 6, 12, 13, 21, and 28	the chemical structures in a polyether that are represented by the formula $C_2H_4O$ with the following structure:  
superfill	1	fill an interconnect feature from the bottom up, rather than at an equal rate on all of its surfaces, to avoid seams and pinching off that can result in voiding
aspect ratio	1	the ratio of the depth of an interconnect feature to its width or diameter expressed as depth:width or depth:diameter
bonded	1, 13, and 28	covalently attached
block co-polymer sequence	6 and 21	a configuration in which a stretch or "block" of one type of repeat units is bonded to a block of a different type of repeat units to form a single chain
random, alternating, or block configuration	13	"random configuration"—a configuration in which the different types of repeat units have no discernable pattern along the chain  "alternating configuration"—a configuration in which the different repeat unit types alternate according to a defined pattern  "block configuration"—a configuration in which a stretch or "block" of one type of repeat units is bonded to a block of a different type of repeat units to form a single chain
interconnect features	1	features having bottoms, sidewalls, and top openings, such as vias or trenches, formed in a dielectric material

'786 Patent Term/Phrase	Claim(s)	Agreed Construction
An electrolytic plating composition for electrolytically plating Cu onto a semiconductor integrated circuit substrate having a planar plating surface and submicron-sized interconnect features by immersion of the semiconductor integrated circuit substrate into the electrolytic solution, the composition comprising	1	The preamble of claim 1 is a limitation. The terms in the preamble should be given their plain and ordinary meaning.
propylene oxide (PO) repeat units, propylene oxide repeat units, and PO repeat Units	1-4, 15, and 16	the chemical structures in a polyether that are represented by the formula $C_3H_6O$ with the following structure:
ethylene oxide (EO) repeat units	1-4, 15, and 16	the chemical structures in a polyether that are represented by a formula $C_2H_4O$ with the following structure:
bonded	1, 6, and 16	covalently attached
block co-polymer sequence	3 and 4	a configuration in which a stretch or "block" of one type of repeat units is bonded to a block of a different type of repeat units to form a single chain
random, alternating, or block configuration	16	"random configuration"—a configuration in which the different types of repeat units have no discernable pattern along the chain

		<p>"alternating configuration"—a configuration in which the different repeat unit types alternate according to a defined pattern</p> <p>"block configuration"---a configuration in which a stretch or "block" of one type of repeat units is bonded to a block of a different type of repeat units to form a single chain</p>
interconnect features	1	features having bottoms, sidewalls, and top openings, such as vias or trenches, formed in a dielectric material

I recommend that the court adopt these agreed-upon definitions as being consistent with how a person of ordinary skill in the art would construe the corresponding claim terms.

## 2. Disputed Terms

With the parties' agreement, the following two claim terms, which are common to both of the patents in suit, remain in dispute and require construction by the court:<sup>6</sup>

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<sup>6</sup> The parties agree that because the '786 Patent is related to the '992 Patent as emanating from a divisional application, the terms common to the two patents are presumed to carry the same meaning. *Omega Emg., Inc. v. Raytek Corp.*, 334 F.3d 1314, 1334 (Fed. Cir. 2003).

<u>Term/Phrase</u>	<u>Claim</u>
suppressor	'786 Patent, Claims 1, 15, 17, and 18; '992 Patent, Claims 1, 12, 14, 15 and 22
wherein the polyether suppressor comprises the structure:	'786 Patent, Claim 18; '992 Patent, Claim 15
$  \begin{array}{c}  \text{H}-(\text{OC}_2\text{H}_4)_n-(\text{OC}_3\text{H}_6)_m \\  \quad \quad \quad \backslash \quad \quad \quad / \\  \quad \quad \quad \text{N} \quad \quad \quad \text{C} \quad \quad \quad \text{N} \\  \quad \quad \quad / \quad \quad \quad \backslash \\  \text{H}-(\text{OC}_2\text{H}_4)_n-(\text{OC}_3\text{H}_6)_m \quad \quad \quad (\text{C}_3\text{H}_6\text{O})_m-(\text{C}_2\text{H}_4\text{O})_n-\text{H}  \end{array}  $	

To help place the court's claim construction analysis in context, it is helpful to consider the relevant patent claims. The method patent in suit, the '992 Patent, contains three independent claims. Representative of those three is Claim 1, which provides as follows:

1. A method for electroplating a copper deposit onto a semiconductor integrated circuit device substrate with electrical interconnect features including submicron-sized features having bottoms, sidewalls, and top openings, the method comprising: immersing the semiconductor integrated circuit device substrate including submicron-sized features having bottoms, sidewalls, and top openings wherein said submicron-sized features include high aspect ratio features having dimensions such that the high aspect ratio features have aspect ratios of at least about 3:1 into an electrolytic plating composition comprising a source of Cu ions in an amount sufficient to electrolytically deposit Cu onto the substrate and into the electrical interconnect features and a polyether **suppressor** compound comprising a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1 and bonded to a nitrogen-containing species, wherein the molecular weight of the **suppressor** compound is between about 1000 and about 30,000; and

supplying electrical current to the electrolytic composition to deposit Cu onto the substrate and superfill the submicron-sized features by rapid bottom-up deposition at a rate of growth in the vertical direction which is greater than a rate of growth in the horizontal direction.

'992 Patent, 18:19-45. (disputed term in bold).

The corresponding composition patent, the '786 Patent, contains only one independent claim, Claim 1, which provides as follows:

1. An electrolytic plating composition for electrolytically plating Cu onto a semiconductor integrated circuit substrate having a planar plating surface and submicron-sized interconnect features by immersion of the semiconductor integrated circuit substrate into the electrolytic solution, the composition comprising:
  - a source of Cu ions in an amount sufficient to electrolytically deposit Cu onto the substrate and into the electrical interconnect features; and
  - a **suppressor** comprising a compound selected from the group consisting of:
    - (i) a first **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the poly ether group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1, and wherein the molecular weight of the first suppressor compound is between about 1000 and about 3600 g/mol;
    - (ii) a second **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the poly ether group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1, wherein the molecular weight of the second suppressor compound is between about 1000 and about 30,000 g/mol, and wherein the second **suppressor** compound further comprises a capping moiety selected from the group consisting of an alkyl group or a block polymer comprising propylene oxide repeat units;
    - (iii) a third **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the poly ether

group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1, wherein the nitrogen-containing species is an alkylether amine, and wherein the molecular weight of the third **suppressor** compound is between about 1000 and about 30,000 g/mol; and

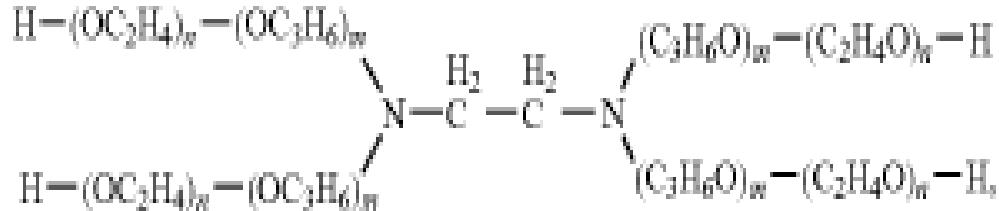
- (iv) a fourth **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the poly ether group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1, wherein the molecular weight of the fourth **suppressor** compound is between about 1000 and about 30,000 g/mol, and wherein a nitrogen in the nitrogen-containing species is a quaternary amine;
- (v) a fifth **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the poly ether group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1, wherein the molecular weight of the fifth **suppressor** compound is between about 1000 and about 30,000 g/mol, and wherein the composition comprises less than about 30 g/l acid when the fifth **suppressor** is selected;
- (vi) a sixth **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the polyether group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) 15 repeat units present in a PO:EO ratio between about 1:9 and about 9:1, wherein the molecular weight of the sixth **suppressor** compound is between about 1000 and about 30,000 g/mol, and wherein the composition comprises between about 4 g/l and about 30 g/l copper ion when 20 the sixth **suppressor** is selected; and
- (vi) [sic] combinations thereof.

'786 Patent, 18:21-19:22 (disputed term in bold).

Claim 15 of the '992 Patent and Claim 18 of the '786 Patent, each of which is dependent on Claim 1 of their respective patents, specify the structure of a particular electrolytic plating composition. Claim 18 of the

'786 Patent exemplifies this specified structure as follows:

18. The electrolytic plating composition of claim 1 wherein the polyether suppressor comprises the structure:



wherein n is between 1 and about 30 and m is between 1 and about 30." '786 Patent, 20:47-54.

a. Suppressor

The asserted claims in this action all require the presence of either a suppressor ('786 Patent) or a suppressor compound ('992 Patent). Each of the independent claims of those patents specifies certain characteristics of the suppressor or the suppressor compound associated with the invention. The parties are in disagreement concerning the meaning of the term "suppressor."

BASF's proposed construction includes specific attributes for the suppressor, tied to the presence of PO and EO repeat units in specific ratios, with additional features. More specifically, BASF proposes that the term "suppressor" be construed to mean "a compound comprising a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and 9:1 and

bonded to a nitrogen-containing species, wherein the molecular weight of the suppressor compound is between about 1,000 and 30,000." Dkt. No. 34-1 at 3-5, 7-9.

As can be seen, BASF urges the court to adopt a construction that does not reference the intended function of the suppressor, but instead centers upon its chemical attributes. BASF argues that its proposed construction is proper because it is consistent with the intrinsic evidence, adding that such a construction was "previously adopted by Enthone and the United States Patent Trial and Appeal Board ("PTAB") in prior actions involving the '992 Patent." Dkt. No. 44, at 9-11, 14.<sup>7</sup>

The focus of the inventions disclosed in the two patents is upon rapid, bottom-up superfilling of copper onto a semiconductor integrated circuit substrate. See, e.g., '992 Patent, Abstract ("The method involves superfilling by rapid bottom-up deposition at a superfill speed by which Cu deposition in a vertical direction from the bottoms of the features to the top openings of the features is substantially greater than Cu deposition on the sidewalls."). The specifications of the two patents provide that the composition and method claimed in them include "a suppressor and an accelerator as additives . . . developed for superfilling." *Id.*, 2:11-13, 3:15-

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<sup>7</sup> As is discussed in more detail below, Enthone did not adopt BASF's proposed construction in any prior proceedings. Nor does the PTAB's ruling require that this court construe "suppressor" in the manner proposed by BASF.

52, 6:19-37, 6:60-7:18; 10:1-11:23; 12:1-5; 12:66-13:53; 14:20-17:65; see also Dkt. No. 43-5 at 14, ¶0006 (United States Patent Application Publication, Dated March 3, 2005, incorporated by reference into the specifications of the patents in suit) ("Systems consisting of a suppressor and an accelerator as additives have been developed for superfilling.").

The specifications of the two patents in suit strongly suggest that there is functionality associated with the suppressor specified – that is, the ability to facilitate rapid bottom-up superfilling of copper. See, e.g., '922 Patent, 18:40-45. The term "suppressor" or its derivative, "suppressor compound," appears in all of the independent claims of the patents in suit. The patents make it clear that the presence of a suppressor is critical to enabling the superfilling process envisioned in the two patents. The language of Claim 1 of the '992 Patent, for example, provides that, to qualify as a "suppressor," the compound must function as a suppressor in the "electrolytic plating composition" to which "electrical current [is supplied] to deposit Cu onto [a semiconductor integrated circuit device] substrate and superfill the submicron-sized features by rapid bottom-up deposition. . . ". '992 Patent at 18:30-45.

The extrinsic evidence now before the court confirms this understanding of the required functionality of a suppressor, as specified in

the two relevant patents.<sup>8</sup> According to Enthone's expert, Dr. Dale Barkey, to constitute a suppressor in the context of the field of the invention, a compound must both inhibit the plating reaction, and be capable of being removed, displaced or excluded by the accelerator from the surfaces of

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<sup>8</sup> With the emphasis on available intrinsic evidence as a preferred source of guidance, extrinsic evidence, such as expert declarations, has been relegated to the role of a secondary source in the claim construction hierarchy, particularly since the Federal Circuit's decision in *Phillips*. As explained by the Federal Circuit in *Phillips*,

[e]xtrinsic evidence in the form of expert testimony can be useful to a court for, *inter alia*, 'establish[ing] that a particular term in the patent or the prior art has a particular meaning in the pertinent field. However, conclusory, unsupported assertions by experts as to the definition of a claim term are not useful to a court.'

*Phillips*, 415 F.3d at 1318 (quoting *Pitney Bowes, Inc. v. Hewlett-Packard, Co.*, 182 F.3d 1298, 1308-09 (Fed. Cir. 1999)); see also *Aristocrat Techs. Australia Pty Ltd. v. Int'l Game Tech.*, 709 F.3d 1348, 1361 (Fed. Cir. 2013). Even in the wake of *Phillips*, however, there is a place for extrinsic evidence in the claim construction inquiry. See, e.g., *Spansion, Inc. v. Int'l Trade Comm'n*, 629 F.3d 1331, 1345 (Fed. Cir. 2010); *Serio-US Indus., Inc. v. Plastic Recovery Technologies Corp.*, 459 F.3d 1311, 1319 (Fed. Cir. 2006); *Network Commerce, Inc. v. Microsoft Corp.*, 422 F.3d 1353, 1361 (Fed. Cir. 2005); see also *Integrated Liner Techs. v. Speciality Silicone Prods.*, 09-CV-1285, 2011 U.S. Dist. LEXIS 124485, \*23-\*27 (N.D.N.Y. Oct. 26, 2011) (considering dictionary definitions and expert witness testimony in construction of the term "adhesive" where the patents at issue "provide[d] little insight as to the intended meaning of [the term]"), report and recommendation adopted by 2011 U.S. Dist. LEXIS 124481 (N.D.N.Y. Oct. 26, 2011); *U.S. Philips Corp. v. Iwasaki Elec. Co.*, No. 03CIV. 0172, 2006 U.S. Dist. LEXIS 106, 2006 WL 20504, at \*1 (S.D.N.Y. Jan. 3, 2006); *Pass & Seymour, Inc. v. Hubbell Inc.*, No. 5:07-CV-00945, 2009 U.S. Dist. LEXIS 130497, 2009 WL 7296903, at \*8 (N.D.N.Y. Dec. 30, 2009) (Peebles, M.J.), adopted as modified, 2011 U.S. Dist. LEXIS 1135, 2011 WL 32433 (N.D.N.Y. Jan. 5, 2011) (Mordue, C.J.).

the inner connect features.<sup>9</sup> Dkt. No. 43-6 at 8-9. This is consistent with the understanding of persons of ordinary skill in the art at the time of invention. *Id.*

BASF's proposed construction does not specify the function of the suppressor in the context of the superfilling of submicron-sized trenches and vias by rapid bottom-up deposition at a rate of growth in the vertical direction that is greater than the growth in the horizontal direction. In this respect, its proposed construction is incomplete.

BASF's proposed construction is separately problematic for three additional reasons. First, BASF injects into the meaning of the term "suppressor" the very chemical attributes that are found elsewhere in the relevant claims, thereby both creating a redundancy and rendering the term superfluous. In essence, BASF invites the court to write the word "suppressor" out of Claim 1 of the '922 Patent. Such a reading runs afoul of the principle that claims should be "interpreted with an eye toward giving effect to all terms in the claim." See *Digital-Vending Servs. Int'l v.*

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<sup>9</sup> This is consistent with commonly understood dictionary definitions of the term "suppressor." See, e.g. Merriam-Webster's Dictionary, <http://www.merriam-webster.com/dictionary/suppressor> (last visited June 13, 2016) (defining "suppressor" as "one that suppresses"); The Am. Heritage Dictionary of the English Language 1740 (Joseph P. Pickett, et al. eds.) 4th ed. 2000 (defining "suppressor" as, *inter alia*, "[a] device, such as a resistor or grid, that is used in an electrical or electronic system to reduce unwanted currents"); Oxford English Dictionary, <http://www.oed.com/view/Entry/194732?redirectedFrom=suppressor#eid> (last visited June 13, 2016) (defining "suppressor" as "[a] device for preventing a machine or part to which it is fitted from causing electrical interference").

*Univ. of Phoenix*, 672 F.3d 1270, 1275 (Fed. Cir. 2012) (quoting *Bicon, Inc. v. Straumann Co.*, 441 F.3d 945, 950 (Fed. Cir. 2006)). As was noted by Enthone, by substituting BASF's proposed construction for the word "suppressor," the relevant portion of Claim 1 would read as follows:

*a compound comprising a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and 9:1 and bonded to a nitrogen-containing species, wherein the molecular weight of the suppressor compound is between about 1,000 and 30,000 comprising a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1 and bonded to a nitrogen-containing species, wherein the molecular weight of the suppressor compound is between about 1000 and about 30,000; . . .*

'992 Patent 18:34-39 (BASF's proposed construction in italics). The redundancy created by adoption of this proposed construction is readily apparent.

Second, independent Claim 17 of the '992 Patent requires a suppressor but does not include specifics concerning the chemical structure of the suppressor. That claim reads as follows:

**17.** A method for electroplating a copper deposit onto a semiconductor integrated circuit device substrate with electrical interconnect features including submicron-sized features having bottoms, sidewalls, and top openings, the method comprising:

immersing the semiconductor integrated circuit device substrate into the electrolytic plating composition comprising a source of Cu

ions in an amount sufficient to electrolytically deposit Cu onto the substrate and into the electrical interconnect features, an accelerator, and a suppressor; and

supplying electrical current to the electrolytic composition to deposit Cu onto the substrate and superfill the submicron-sized features by rapid bottom-up deposition at a vertical Cu deposition growth rate in features from the bottoms of the features to the top openings of the features which is greater than 15 times faster than a field deposition growth rate on substrate surfaces outside the features.

'992 Patent at 20:40-59. Claim 18, which is dependent upon Claim 17 – and thus limits its scope – recites additional specific limitations concerning the chemical structure and characteristics of the suppressor as follows:

**18.** The method of claim 17 wherein the suppressor compound has a molecular weight between about 1000 and about 30,000 and comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1.

*Id.* at 20:60-64.

Since Claim 18 includes the PO/EO molecular weight limitations already included in BASF's proposed construction of the term suppressor, to adopt BASF's proposed construction would render Claim 18 redundant of Claim 17 and violate the doctrine of claim differentiation, under which "limitations stated in dependent claims are not to be read into the independent claim from which they depend." *Nazomi Comnc's NS v. Arms Holdings, PLC*, 403 F.3d 1364, 1370 (Fed. Cir. 2005) (quoting *Karlin Tech., Inc. v. Surgical Dynamics, Inc.*, 177 F.3d 968, 971-72 (Fed.

Cir. 1999).

Third, Claim 1 of the '786 Patent specifies a Markush group of possible suppressor compounds as follows:

a **suppressor** comprising a compound selected from the group consisting of:

- (i) a first **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the poly ether group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1, and wherein the molecular weight of the first suppressor compound is between about 1000 and about 3600 g/mol;
- (ii) a second **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the poly ether group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1, wherein the molecular weight of the second suppressor compound is between about 1000 and about 30,000 g/mol, and wherein the second **suppressor** compound further comprises a capping moiety selected from the group consisting of an alkyl group or a block polymer comprising propylene oxide repeat units;
- (iii) a third **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the poly ether group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1, wherein the nitrogen-containing species is an alkylether amine, and wherein the molecular weight of the third **suppressor** compound is between about 1000 and about 30,000 g/mol; and
- (iv) a fourth **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the poly ether group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1, wherein the molecular weight of the fourth **suppressor** compound is between about 1000 and about 30,000 g/mol, and wherein a nitrogen in the nitrogen-containing species is a quaternary amine;

- (v) a fifth **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the poly ether group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) repeat units present in a PO:EO ratio between about 1:9 and about 9:1, wherein the molecular weight of the fifth **suppressor** compound is between about 1000 and about 30,000 g/mol, and wherein the composition comprises less than about 30 g/l acid when the fifth **suppressor** is selected;
- (vi) a sixth **suppressor** compound comprising a polyether group bonded to a nitrogen-containing species, wherein the polyether group comprises a combination of propylene oxide (PO) repeat units and ethylene oxide (EO) 15 repeat units present in a PO:EO ratio between about 1:9 and about 9:1, wherein the molecular weight of the sixth **suppressor** compound is between about 1000 and about 30,000 g/mol, and wherein the composition comprises between about 4 g/l and about 30 g/l copper ion when 20 the sixth **suppressor** is selected; and
- (vi) [sic] combinations thereof.

'786 Patent, 18:31-19:22.<sup>10</sup> As can be seen, subpart (i) of Claim 1 describes a suppressor compound as having between about 1000 and about 3600 g/mol molecular weight. *Id.* at 18:38-40. BASF's proposed construction of suppressor requires the suppressor compound to have a molecular weight of between 1000 and 30,000 g/mol, creating a potential inconsistency with this portion of Claim 1. *Id.*, 18:57-60. Stated differently, BASF's proposed construction is in conflict with the composition specified in subpart (i) of Claim 1, and therefore cannot be correct.

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<sup>10</sup> "A Markush group is a listing of specified alternatives of a group in a patent claim, typically expressed in the form: a member selected from the group consisting of A, B, and C." *Abbott Labs. v. Baxter Pharm.*, 334 F.3d 1274, 1280 (Fed. Cir. 2003).

For these reasons, I recommend that the court reject BASF's proposed construction.

In its submissions, Enthone offers a construction that is principally generic, although contextually tied to the damascene process, proposing that "suppressor" be construed to mean "a compound that inhibits electrolytic copper plating and facilitates superfilling of submicron interconnect features in a system having an accelerator."<sup>11</sup> As can be seen, the construction advanced by Enthone focuses upon the function to be served by the suppressor or suppressor compound. Enthone argues that its proposed construction is proper because it is supported by intrinsic and extrinsic evidence.

As an initial matter, I do not find that Enthone previously adopted BASF's proposed construction in connection with an action brought by Enthone in this court against another direct competitor, Moses Lake Industries ("MLI"),<sup>11</sup> and in *inter partes* review proceedings ("IPR") commenced by MLI involving the patents now in suit. As was noted by Enthone, in the MLI litigation, it was uncontested that the allegedly infringing products contained both an accelerator and a suppressor to achieve superfilling, and thus it was not necessary for Enthone to oppose

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<sup>11</sup> *Enthone Inc. v. Moses Lake Indus., Inc.* No. 1:13-CV-1054 (TJM/RFT) (N.D.N.Y. Filed 2013).

MLI's proposed construction for purposes of Enthone's preliminary injunction motion. See Dkt. No. 43 at 20. Claim construction was never addressed by the court in the MLI litigation, and, as Enthone points out, its expert in that case, Dr. Barkey, provided the same opinion concerning the meaning of the term "suppressor" as has been offered in this case.

*Compare* Dkt. No. 43-6 at 7-9 with Dkt. No. 46-4 at 3.

Moreover, the IPR proceedings before the PTAB are of limited relevance because the PTAB applies the broadest reasonable interpretation to all terms that it construes, a standard that is more expansive than that applied by the courts when engaging in claim construction. See *PPC Broadband, Inc. v. Corning Optical Communications RF, LLC*, 815 F.3d 734, 740-742 (Fed. Cir. 2016). While Enthone apparently agreed with MLI that the suppressor must contain certain specified chemical properties – a point on which BASF relies in arguing that its proposed construction should be adopted – such a limitation is consistent with the language of the relevant patent claims. In other words, any concession by Enthone before the PTAB that a suppressor must contain certain specified chemical properties in accordance with other claim language is not inconsistent with Enthone's

proposed construction in this case.<sup>12</sup> Indeed, in its decision, the PTAB noted that it did not reach the question of whether the Enthone's proposal concerning functionality should be added, concluding that "[w]hether a 'suppressor' is also limited to 'compounds that provide the function of suppression in the claimed method' is not material to our decision.

Therefore we do not reach that issue." Dkt. No. 43-11 at 9.

A second battleground associated with Enthone's proposed construction concerns whether it must function in a system having an accelerator. As BASF correctly argues, the '786 Patent, which claims compositions for electrolytically plating copper, makes no reference to an accelerator.<sup>13</sup> Moreover, at various points in the specification, reference is made to the need to include in the composition disclosed a source of copper ions and a suppressor. See, e.g. '786 Patent, 3:30-38 ("the composition comprises a source of Cu ions in an amount sufficient to electrolytically deposit Cu on to the substrate and into the electrical interconnect features and a suppressor compound comprising . . .").

It is true that, later in the specification, the '786 Patent references

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<sup>12</sup> It also bears noting that Enthone's proposed construction of "suppressor" before the PTAB is consistent with its proposed construction in this case. See Dkt. No. 43-11 at 8-9 (arguing that the term should be construed as "compounds that provide the function of suppression in a claimed method" (i.e., superfill)).

<sup>13</sup> The only references in the claims of the '992 Patent to an accelerator are found in independent Claim 17 as well as Claims 18, 19, and 27 to the extent they are dependent upon Claim 17. See '992 Patent, 20:40-22:7.

another aspect of the invention to include an "electrolytic plating composition comprising a source of Cu ions in an amount sufficient to electrolytically deposit Cu onto the substrate and into electrical interconnect features, an accelerator, and a suppressor; . . . . *Id.* at 3:48-52. Yet further on, when describing the specified electrolytic compound, the '786 Patent states that, in addition to "a suppressor compound and a source of Cu ions[,] [t]hese compositions also *typically* comprise a leveler, an accelerator, and chloride." *Id.* at 4:41-45. (emphasis added). This is consistent with the statements of plaintiff's expert, Dr. Barkey, who observes that, "[a]s described in the two patents, the Enthone inventors discovered that such suppressors, in combination with an accelerator, were able to superfill submicron size interconnect features with high aspect ratios of at least about 3:1." Dkt. No. 43-6 at 5.

While these statements shed light on a typical aspect of the invention, neither the claims of the two patents in suit, nor the specifications, appear to require, in every instance, that the suppressor be joined with an accelerator. In other words, a person of ordinary skill in the art might agree that the use of an accelerator is helpful to the superfilling process in overriding the functionality of the suppressor once trenches are filled sufficiently. However, there is nothing within the patent specifications or claims to suggest that the presence of an accelerator is required in

every instance. I therefore recommend that the court reject the additional requirement, as urged by Enthone, that the term "suppressor" be construed to include a provision that it be contained within "a system having an accelerator."

Based upon the foregoing, I recommend that the term "suppressor" be construed to mean "a compound that inhibits electrolytic copper plating and facilitates superfilling of submicron interconnect features."

b. Polyether Suppressor Structure Claim Term

The second claim construction dispute between the parties relates to claim language that appears in dependent Claim 15 of the '992 patent and dependent Claim 18 of the '786 patent. For its part, Enthone proposes that Claim 15 of the '992 patent and Claim 18 of the '786 patent be construed to mean "the polyether suppressor described in claim 1 having the depicted chemical structure, whose PO and EO repeat units are arranged in random, alternating, or block configurations; bonded to a nitrogen; and capped by a hydrogen." Dkt. 34-1 at 5, 9. BASF proposes a slightly different construction, whereby in the specified structure, "n and m are selected such that the suppressor has between 4 and about 120 total PO repeat units and between 4 and about 120 total EO repeat units on the four PO/EO block copolymer portions in the structure." *Id.* As the parties agree, their dispute therefore turns on whether the suppressor is

limited to a block copolymer configuration. *Compare* Dkt. No. 43 at 21-22 with Dkt. No. 47 at 22.

As BASF correctly notes, in the specification, the patents repeatedly refer to structure (5) as "a PO/EO *block copolymer* of ethylenediamine." '992 Patent, 8:12-26; '786 Patent, 8:22-38 (emphasis added). However, as Enthone correctly points out, nowhere in the claim or written description is the depicted structure limited to a block copolymer. Indeed, the '992 Patent specifically provides to the contrary, stating that "[t]he polyether preferably comprises EO repeat units and PO repeat units *in random, alternating, or block configurations.*" See '992 Patent 5:52-54. (emphasis added). Moreover, BASF's reliance upon an exemplary structure for its proposed construction violates the well-established rule against importing limitations from a specification, including a particular example or embodiment, into a claim term.<sup>14</sup> See *Deere & Co., v. Bush Hog, LLC*, 703 F.3d 1349, 1354 (Fed. Cir. 2012) ("[A] claim construction must not import limitations from the specification into the claims."); see also *Flo Healthcare Solutions, LLC v. Kappos*, 697 F.3d 1367, 1375 (Fed. Cir. 2012) ("[I]t is not proper to import from the patent's written description limitations that are not found in the claims themselves.").

BASF's proposed construction would also eviscerate any distinction

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<sup>14</sup> The specification of the '786 Patent expressly notes that those structures are "exemplary suppressor compounds." '786 Patent, 8:16-22.

between Claim 15 of the '992 Patent and Claim 21 of that same patent. Claim 21, which is dependent upon Claim 15 containing the language now in dispute, limits the propylene oxide repeat units and ethylene oxide repeat units to arrangement "in a block copolymer sequence." '992 Patent, 21:4-5. The construction of the Claim 15 language now proposed by BASF would render Claim 21 redundant and meaningless, which would be incorrect under the circumstances. See *Tandon Corp. v. U.S. Int'l Trade Comm'n*, 831 F.2d 1017, 1023 (Fed. Cir. 1987) ("There is presumed to be a difference in meaning and scope when different words or phrases are used in separate claims[, and thus when] the absence of such difference in meaning and scope would make a claim superfluous, the doctrine of claim differentiation states the presumption that the difference between claims is significant."); *FotoMedia Techs., LLC v. AOL, LLC*, 07-cv-255, 2009 U.S. Dist. LEXIS 62542, \*54-\*55 (E.D. Tex. July 21, 2009) (rejecting proposed construction that would result in interpreting "claim terms to mean the same thing," rendering one claim meaningless).

In short, I agree with Enthone that Claim 15 of the '992 Patent and Claim 18 of the '786 Patent should not be construed to limit the depicted structure to a block copolymer. Rather, the claim language should be construed to allow the polymer chain to be structured in random,

alternating, or block copolymer configurations.<sup>15</sup> I therefore recommend that the court adopt Enthone's proposed construction of these claim terms, and that, for purposes of Claim 15 of the '992 Patent and Claim 18 of the '786 Patent, the structural limitation be construed to mean "the polyether suppressor described in Claim 1 having the depicted chemical structure, whose PO and EO repeat units are arranged in random, alternating, or block configuration; bonded to a nitrogen; and capped by a hydrogen."

#### IV. SUMMARY AND RECOMMENDATION

Based upon the parties' oral and written presentations, and after having carefully considered the available intrinsic evidence, and, to the limited extent necessary, extrinsic evidence, it is hereby respectfully

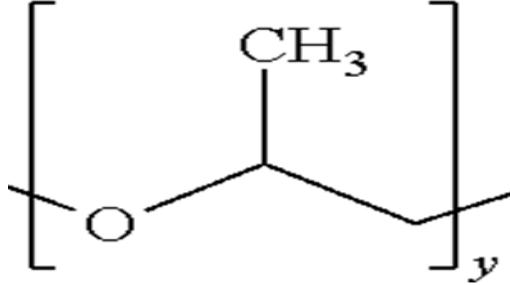
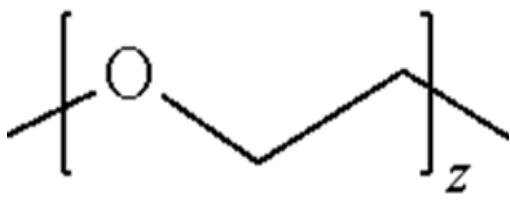
RECOMMENDED that the court adopt the following constructions of the claim terms in issue in this matter:

##### (1) Agreed Upon Terms

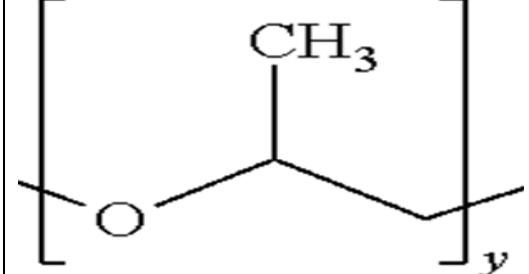
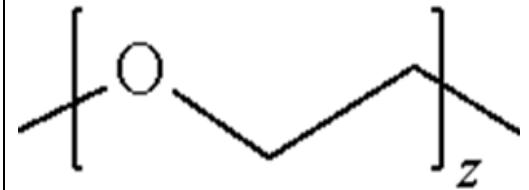
'992 Patent Term/Phrase	Agreed Construction
a method for electroplating a copper deposit onto a semiconductor integrated circuit device substrate with electrical interconnect features including submicron-sized features having bottoms, sidewalls, and top openings, the method comprising:	The preamble of claim 1 is a limitation. The terms in the preamble should be given their plain and ordinary meaning.

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<sup>15</sup> As was noted above, the parties have agreed on the terms "random configuration," "alternating configuration," and "block configuration." Dkt. No. 34-1 at 3.

'992 Patent Term/Phrase	Agreed Construction
propylene oxide (PO) repeat units, propylene oxide repeat units, and PO repeat Units	<p>the chemical structures in a polyether that are represented by the formula <math>C_3H_6O</math> with the following structure:</p> 
ethylene oxide (EO) repeat units	<p>the chemical structures in a polyether that are represented by a formula <math>C_2H_4O</math> with the following structure:</p> 
superfill	<p>fill an interconnect feature from the bottom up, rather than at an equal rate on all of its surfaces, to avoid seams and pinching off that can result in voiding</p>
aspect ratio	<p>the ratio of depth of an interconnect feature to its width or diameter expressed as depth:width or depth:diameter</p>
bonded	<p>covalently attached</p>
block co-polymer sequence	<p>a configuration in which a stretch or "block" of one type of repeat units is bonded to a block of a different type of repeat units to form a single chain</p>
random, alternating, or block configuration	<p>"random configuration"—a configuration in which the different types of repeat units have no discernable pattern along the chain</p> <p>"alternating configuration"—a configuration in which the different repeat unit types alternate according to a defined pattern</p> <p>"block configuration"—a configuration in which a stretch or "block" of one type of</p>

<u>'992 Patent Term/Phrase</u>	<u>Agreed Construction</u>
	repeat units is bonded to a block of a different type of repeat units to form a single chain
interconnect features	features having bottoms, sidewalls, and top openings, such as vias or trenches, formed in a dielectric material

'786 Patent Term/Phrase	Agreed Construction
An electrolytic plating composition for electrolytically plating Cu onto a semiconductor integrated circuit substrate having a planar plating surface and submicron-sized interconnect features by immersion of the semiconductor integrated circuit substrate into the electrolytic solution, the composition comprising	The preamble of claim 1 is a limitation. The terms in the preamble should be given their plain and ordinary meaning.
propylene oxide (PO) repeat units, propylene oxide repeat units, and PO repeat Units	the chemical structures in a polyether that are represented by the formula $C_3H_6O$ with the following structure: 
ethylene oxide (EO) repeat units	the chemical structures in a polyether that are represented by a formula $C_2H_4O$ with the following structure: 
bonded	covalently attached
block co-polymer sequence	a configuration in which a stretch or "block" of one type of repeat units is bonded to a block of a different type of repeat units to form a single chain
random, alternating, or block configuration	<p>"random configuration"—a configuration in which the different types of repeat units have no discernable pattern along the chain</p> <p>"alternating configuration"—a configuration in which the different repeat unit types alternate according to a defined pattern</p>

	<p>"block configuration"—a configuration in which a stretch or "block" of one type of repeat units is bonded to a block of a different type of repeat units to form a single chain</p>
interconnect features	<p>features having bottoms, sidewalls, and top openings, such as vias or trenches, formed in a dielectric material</p>

**(2) Claim Terms in Dispute**

NOTICE: Pursuant to 28 U.S.C. § 636(b)(1), the parties may lodge written objections to the foregoing report. Such objections must be filed with the clerk of the court within FOURTEEN days of service of this report.

FAILURE TO SO OBJECT TO THIS REPORT WILL PRECLUDE

APPELLATE REVIEW. 28 U.S.C. § 636(b)(1); Fed. R. Civ. P. 6(a), 6(d), 72; *Roldan v. Racette*, 984 F.2d 85 (2d Cir. 1993).

It is hereby ORDERED that the clerk of the court serve a copy of this

report and recommendation upon the parties in accordance with this court's local rules.

Dated: June 17, 2016  
Syracuse, NY



David E. Peebles  
David E. Peebles  
U.S. Magistrate Judge